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(54) Sanitary installations with illuminated water

(57) A Sanitary installation such as a bath, shower or washbasin is provided with electromagnetic waves, especially visible lights (1), introduced into the water streams (10, 7) before or immediately after the said water streams exit from the shower head (4) or water taps so that part or all of these lights (6) are carried and guided by the water streams (8) when exiting from the shower/tap head (4) because of higher optical refractive index of the water compared to the air. The colours and/or patterns and/or the intensities of the said light injected into the said water can be adjusted manually or automatically according to certain water conditions such as the temperature or the flowrate/pressure or quality of the water in use. The said optical source (1) can be placed at the said shower/tap head (4) or separated from it. In the latter case fibre optic means (19), reflective mirror means (15) or optical waveguide means, can be used to guide the optical energy from the said light source (1) to the appropriate water streams (10 or 7). The light source (1) can also be placed or embedded in the bath tubs for the illuminated water effects.

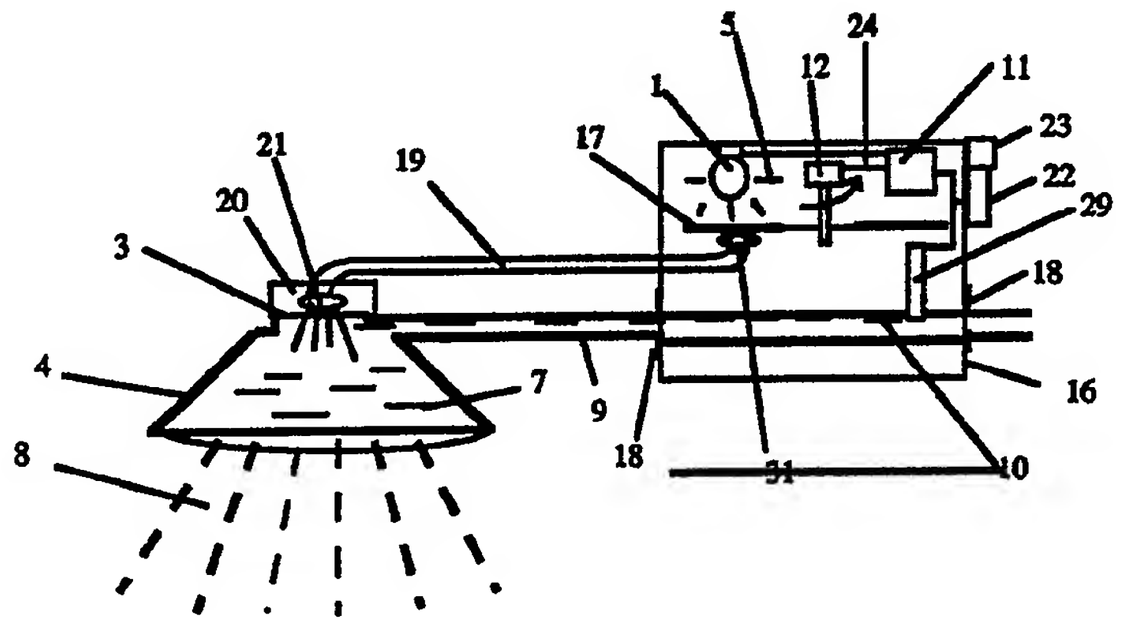

Fig.4.

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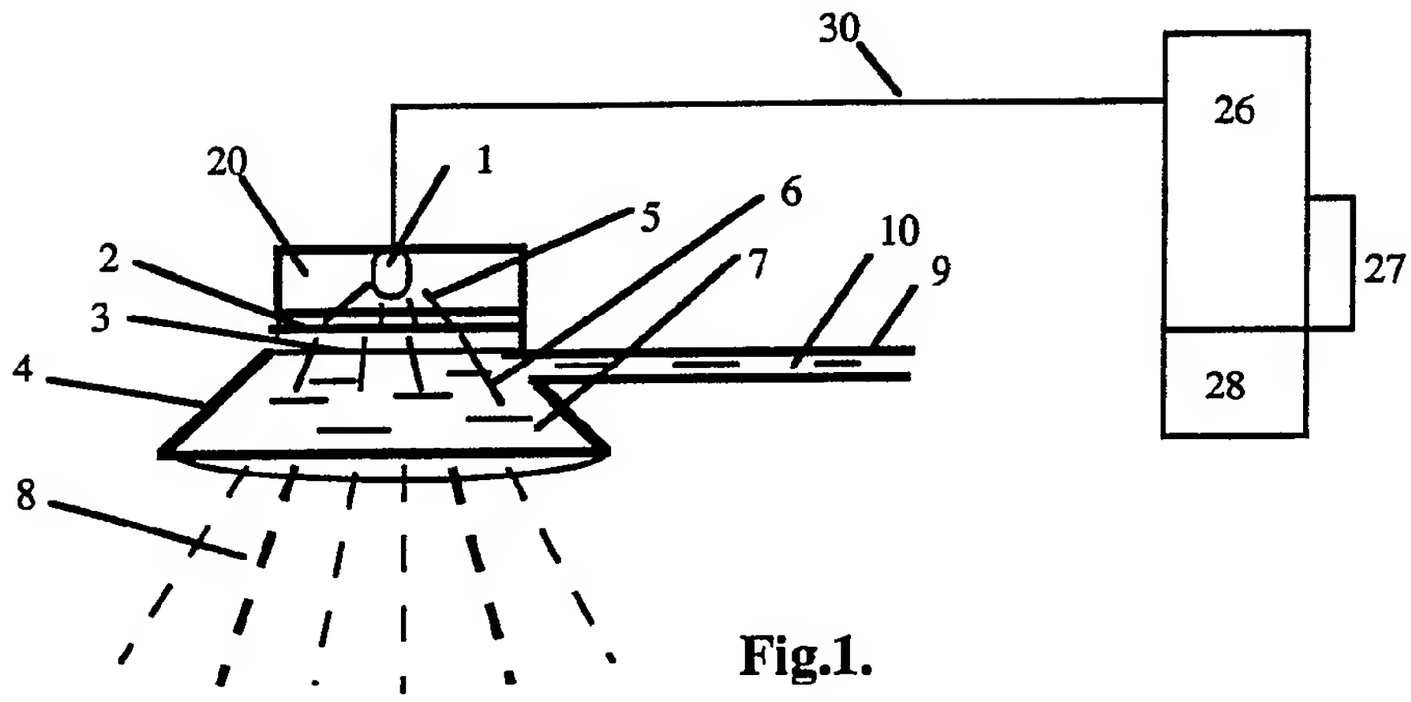

Fig.1.

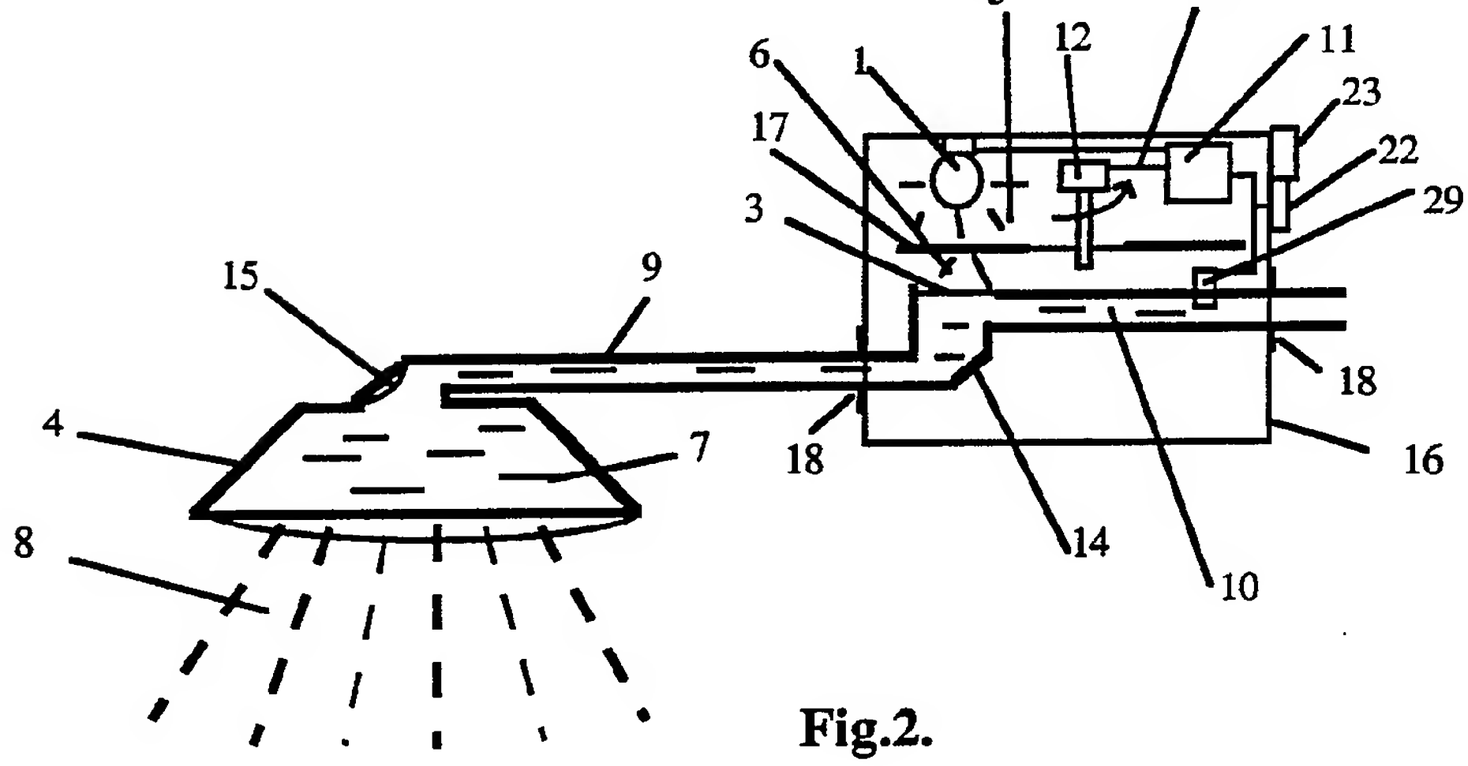

Fig.2.

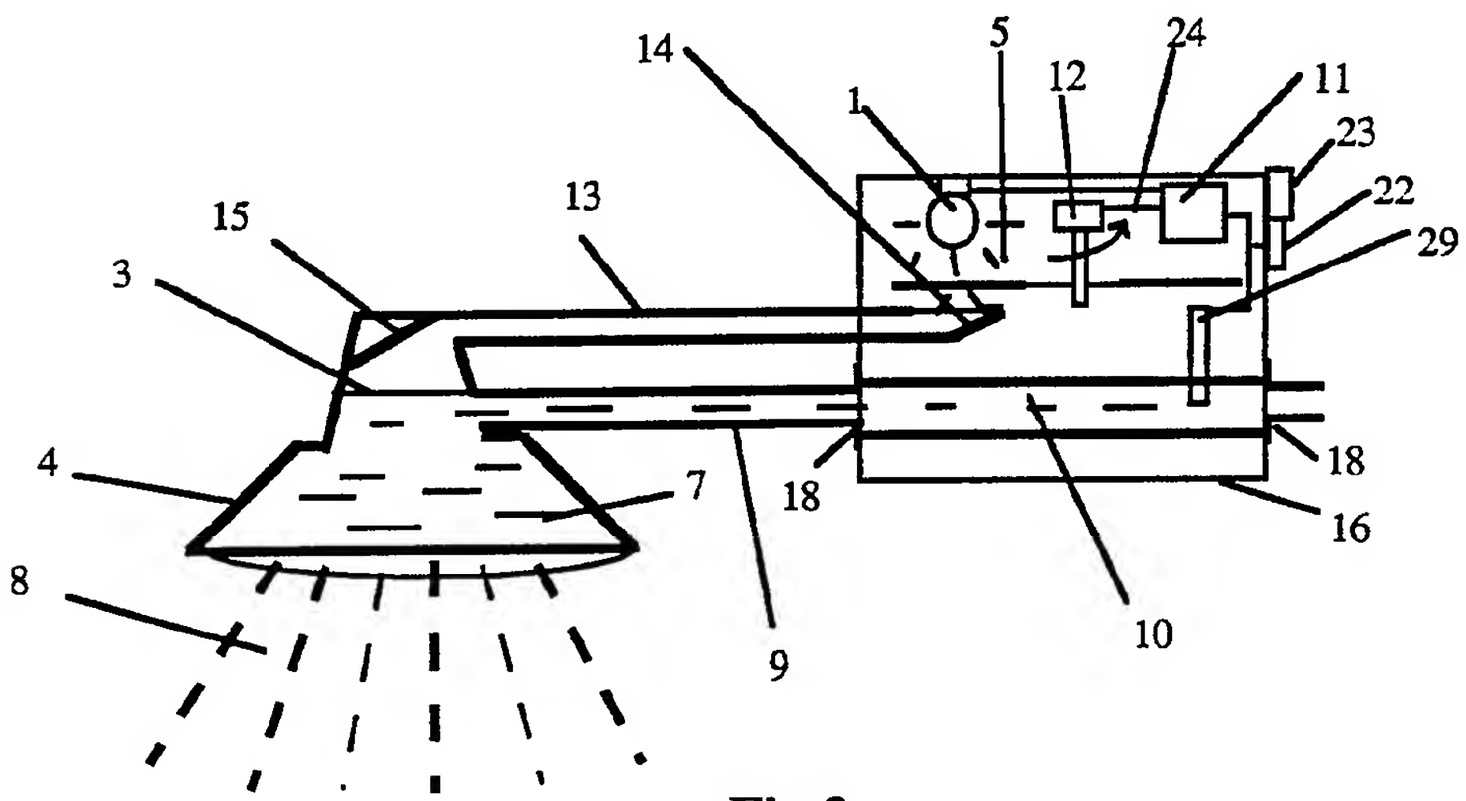

Fig.3.

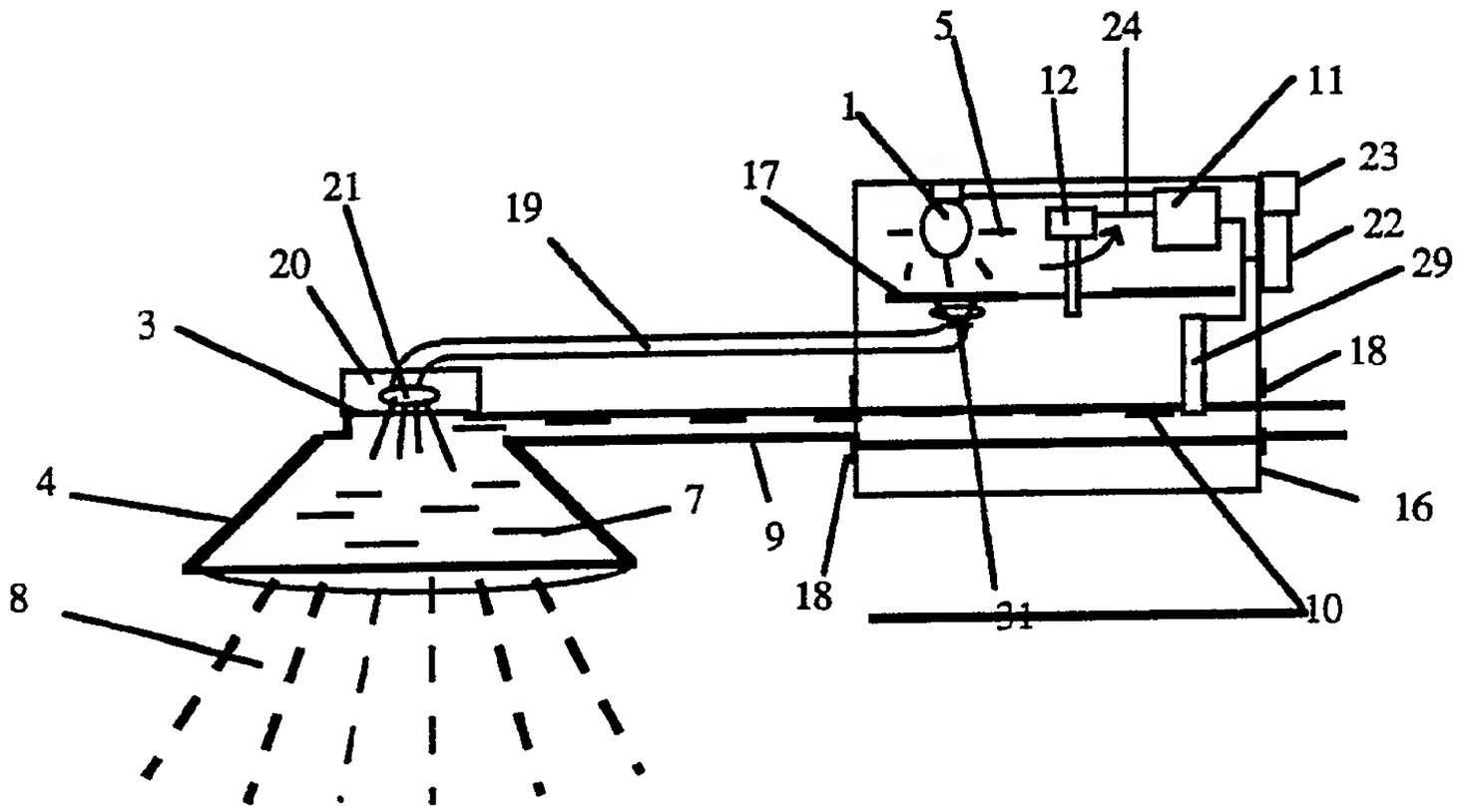
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Fig.4.

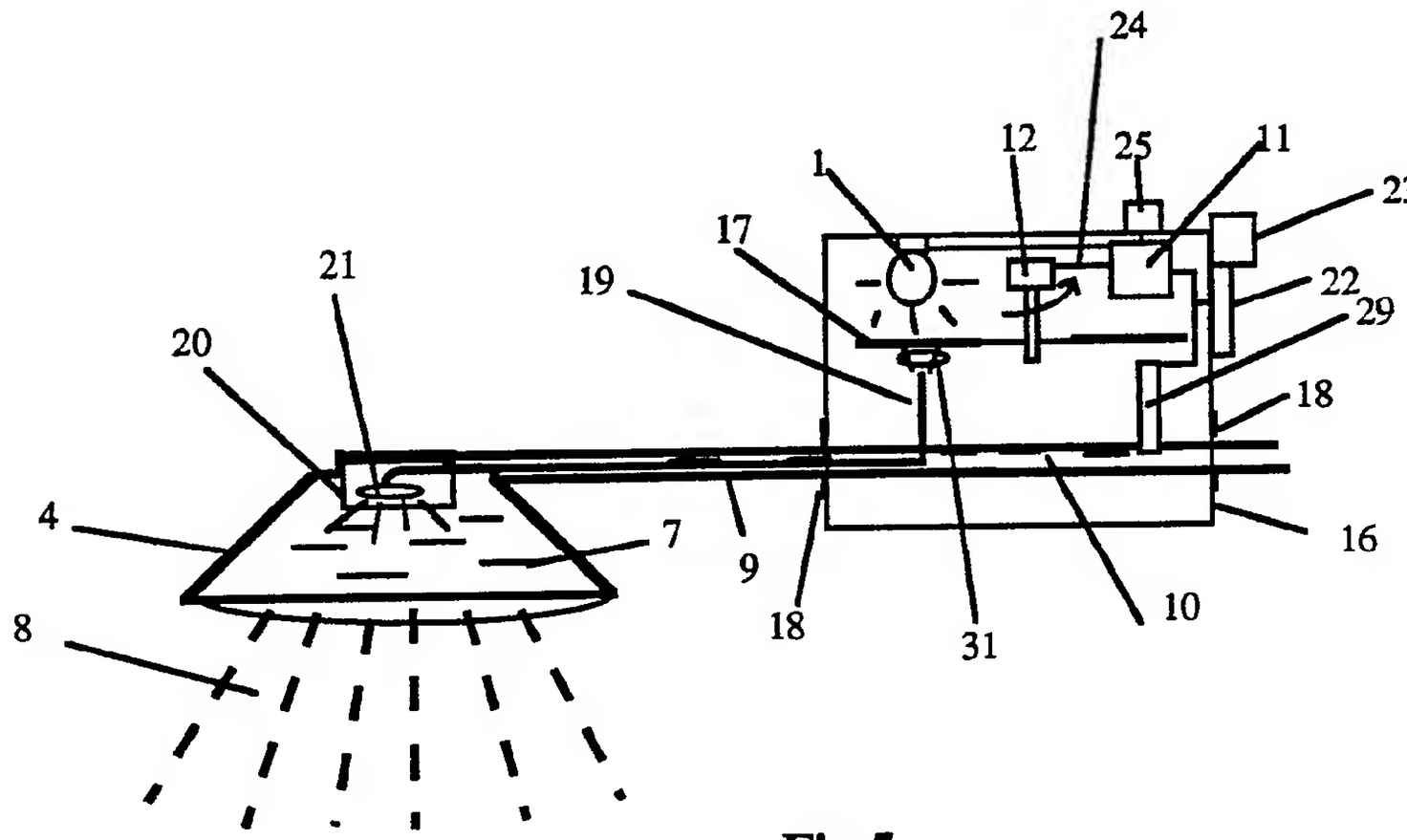
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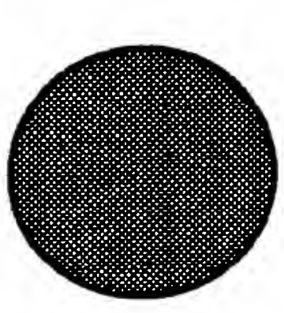
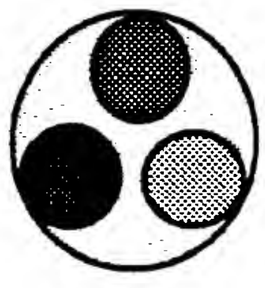
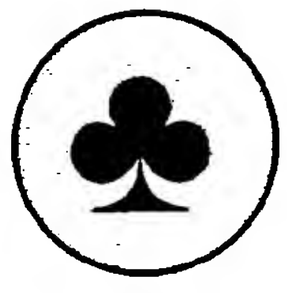
Fig.5



2.A

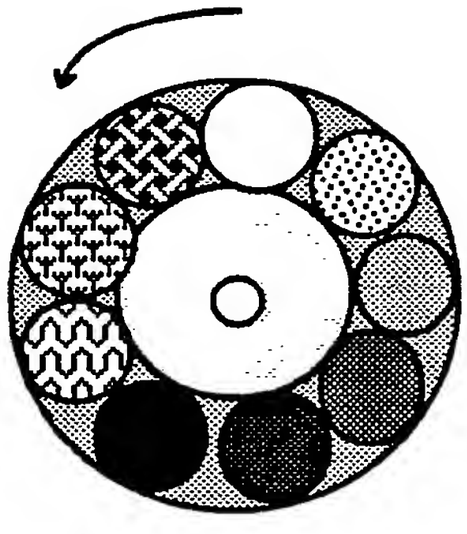


2.B

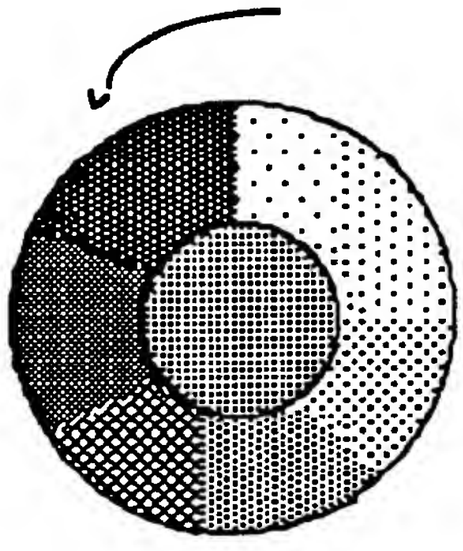


2.C

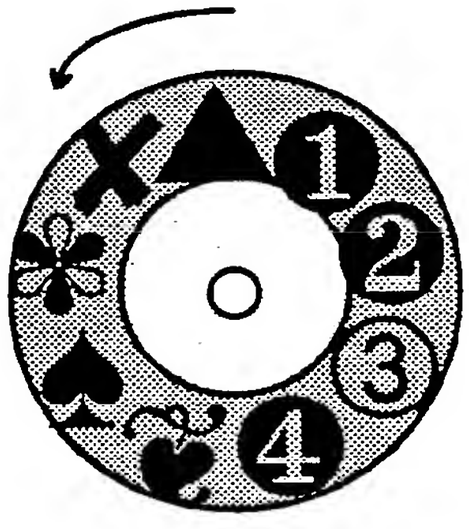
Fig.6



17.A



17.B



17.C

Fig.7.

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SANITARY INSTALLATIONS WITH ILLUMINATED WATER

TECHNICAL FIELD

The present invention relates to methods and apparatus for improving convenience, safety and pleasure of sanitary such as showering, bathing or hand/face washing by introducing electromagnetic waves, especially visible lights into the water steams used in the sanitary installations before or immediately after the said water exits from the shower head or water tap so that these lights are carried by, mixed with and directed by the said water streams exiting the shower/tap head for sanitary use. The said water streams are capable of trapping and carrying light with them because of higher optical refractive index of the water compared to the air. Especially if the light from inside the water strikes the water/air interface at angles beyond a critical value, total reflection of the light within the water stream may be resulted. Thus an illuminated effect of the water stream in use can be produced. The colour and/or patterns and/or the intensity and/or pulse frequency and/or pulse duty cycles and/or shapes, and/or wavelength/spectrums of the said light can be adjusted manually or automatically according to the user's demand or certain water conditions such as the temperature or the flowrate/pressure or quality of the said water (pH values, hardness, cleanness etc.) which can be detected with one or a number of water condition sensing means. This feature enables the user to know the water condition visually by looking directly at the water streams out of the shower/tap head without having to tough the water. The said light source can be placed at the said shower/tap head or separated from it. In the latter case fibre optic means, reflective mirror means or optical waveguide means, can be used to guide the optical energy from the said light source to the appropriate water streams. The light source can also be placed, introduced or embedded in a bath tub. When the bath is filled with water, optical illumination effects can also be resulted including the total reflection effects. Water condition related light parameter changes can also be incorporated in the bath case. Further an audible sound production means can be incorporated into the said sanitary installations to produce sound or musics or warning signals according to water conditions or the said light variations.

The above features will provide an increased convenience, safety (especially for child and skin sensitive persons), beauty and pleasure of sanitary because of the illuminated/coloured water streams flowing over the user body and non-contact means of indicating the water condition. For industrial and environmental water monitoring, it also provides a convenient way of indicating the water conditions at the user end by directly viewing the water colours or other light parameters such as intensity, patterns coming out of the water taps. When the light injected into the water streams resembles the sunlight spectrum (ultraviolet light may not be included for safety reasons) with certain brightness, a two-in-one combined sun bathing and showering sanitary installation can be resulted. Further if the injected light/electromagnetic waves are in certain selected spectrum such as infrared spectrum, the resulted light carrying water sanitary installations can be used for medical treatment or medication purposes. Other applications of the invented installations may exit depending on

the light wavelength and patterns.

BACKGROUND ART

Water sanitary such as showering, bathing and hand/face washing with hot and/or cold water are part of everyday life for most of people on our planet. The existing sanitary systems used in domestic and commercial places (such as hotels) provide plain water with no colour or optical lights carried in the water streams. Further the water temperature control is often by means of manual adjustment or certain degree of automatic means without means of direct indicating the actual water temperature in use. Thus often a period of time is required before the water reaches the set temperature. Often people use direct body contact method to "feel" the actual water temperature. Accidents such as hot water burning of skins (especially for children) or cold water caused illness, or chemical or acid damage to the skins (especially for those who have sensitive skins or skin problems) due to water, say, pollutions or excessive chemicals in the water, can occur for the existing sanitary systems due to the lack of direct, non-contact means of indicating the water conditions. If the shower head or water taps used in sanitary installations can produce colourful rains of light in the water streams, additional pleasure can be enjoyed by the user. Especially for children, the fun of shower could be increased with colourful light coming with the water they use. If the colour or pattern or intensity of the light carried by the water streams exiting from the shower head or water taps can vary with the water condition such as temperature, pressure or cleanness of the water, great convenience and safety of sanitary can be provided.

Sun bathing has been one of the pleasures and healthy practice for human being. Especially sun bathing at sea beaches or by the swimming pools where water playing and sun bathing can be enjoyed together (but not simultaneously!). However either because of time or cost or weather concern, people may not be able to enjoy the sun bathing as they wanted. Although facilities are available to produce simulated sun light at homes for dried sun bathing, the fun of sun bathing with waters can not be produced. If it can be provided sanitary installations combining the light and waters, especially the light being able to travel with the waters, showering, bathing and hand/face washing can be at the same time be sun bathing when the light spectrum used in the said light source resembles the sun light spectrum, all parts of the body can be sun bathed and water bathed at the same time.

Using infrared lights or rays for medical treatment of human body or perhaps animal skin have been practised world wide. This is often done by placing part of human or animal body at or near an infrared wave generator such as an infrared light bulb. The treatment can result in an improved healing of a wound or skin illness or the relief of sore or pain. With the present invention the provided sanitary installations can provide sanitary and infrared medical treatment at the same time if the said injected light/electromagnetic waves are selected to be in certain infrared spectrum.

Illumination of bath room space with different types of lighting facilities such as colour light on the ceiling or walls of the room have

been seen in some of the commercial installations such as hotels as well as domestic environment. However these lightings have no connection what so ever to the sanitary installations and the lights are not introduced into the water streams to be carried to the user. Lights from such lightings could shine on the water streams exiting from the shower head or water taps when the angle of the light or shower head or water tap is right. However because of much reduced intensity of light that shine on the water (since other parts of the light are used for the illumination of the room space) and the angle of incidence of the light to the water is not controlled, the light rays usually just pass through the transparent water and travel separately with the water streams. The illuminated effect on water thus can not be resulted. Further, these lights are not related to the sanitary water conditions such as temperature of the water.

Lights or coloured lights in the water have been seen in commercial light shows and displays such as light fountains. These waters and installations are not for sanitary purposes thus there is no direct contact of the optically illuminated water with human body. Therefore they does not contribute to the pleasure and convenience for people using sanitary equipments at homes or hotels or other places. Further the lights used for illuminated fountains have not been used to indicate water conditions such as temperatures or quality of water to benefit for end users of the water.

In environmental water monitoring practice, colorimeter and photometers are used for water quality testing in industries. These meters involve deposition of certain chemical agents into the testing water sample collected and separated from the water stream and placed in a transparent test tube so that a chemical reaction takes place between the added agents and certain chemicals in the water. These reactions can result in water colour changes. Thus by shining a light through the testing water, the intensity, colour or spectrum of the light through the water can be detected with a sensor. These are related to the content of the certain chemicals in the water to indicate water quality according to the know chemical reactions. In these processes the water samples used for testing (adding chemicals and passing light through) are polluted by the added chemicals and are not going to be reused by end users. Here the testing water (stationary) is used for light filtering for testing purposes which certainly is not suitable for sanitary purposes. Further the light is not travelling with the water and carried to be in contact with the end user for sanitary purposes.

DISCLOSURE OF THE INVENTION

According to the present invention there is provided sanitary installations such as showering, bathing or hand/body washing systems with illuminated water by introducing electromagnetic waves, especially, visible lights into the water streams before or just after the said water exit from the shower head or water taps so that these water streams are illuminted and the light is trapped and carried by the water streams flowing out the said shower head or water taps due to higher optical refactive index or the water compared to air. Further the colour, and/or intensity, and/or patterns and/or wavlengths and/or polarisation status of the said light can be varied with the water condition such as the

temperature of the water. It is one object of the present invention to increase the convenience, safety and pleasure of the sanitary. It is another object of the invention to provide means of direct, non-contact indication of water conditions by the illumination condition in the water stream in use.

In one embodiment of the invention a light beam or a number of light beams are injected or projected or introduced into the shower/tap water streams before or just after the said water exits the said shower head or the said water tap so that the said light is trapped in and carried by the water streams which behave like optical fibres resulting in an illuminated water flowing out of the said shower head or water taps due to higher optical refractive index of the water compared to the air.

In another embodiment of the invention the said light beams injected or projected into the said water streams can be a white light (broad spectrum), single coloured or multiple coloured or mixed coloured, continuous or pulsed, constant brightness or varying brightness, patterned or plain, uniformly distributed or not uniformly distributed, polarised or not polarised, stationary or in motion.

In a further embodiment of the invention the said light source can be one or a number of light bulbs in various shapes, or light emitting diodes or arc lamps or lasers or other types of electromagnetic wave generators.

In a further embodiment of the invention the said light source can be placed on, at, around, or in close proximity of the said shower head or water tap, or placed separated from the said shower head or water tap.

In a further embodiment of the invention, optical components such as light reflecting mirror means (e.g. polished metal mirrors or glass mirrors or optical prisms), lens means (e.g. focusing lenses of various shapes in various combinations, diffusing lenses), flexible waveguide means (tubes that transmit light from one end to the other by multiple reflections of the light on the inner walls of the tube. Preferably reflective coatings at the inner walls are used to reduce the loss of light energy) and commercial optical fibres means (e.g. glass optical fibres) can be used to transmit the said light beams from the said light source (which can be separated from the said shower head or water tap) into the said water streams so that the electrical components can be avoided at the user end.

In a still further embodiment of the invention, optical mask means (means of partially blocking, transmitting, colouring of the light depending on the geometry and patterns and colours and status of the mask. Plastic or glass sheets or dye/liquid filled transparent windows with various colours and patterns, liquid crystal displays or LCD and polarisation control crystals are examples of optical masking means) or optical filter means (which selectively passes certain wavelength(s) of the light depending on the filter materials, colours or coatings) with various colours and/or artistic patterns, or mechanical shopping means (periodically blocking the beam) can be placed between the said light source and the said water streams to produce patterned and/or coloured or pulsed light in the said water or shower streams.

In a still further embodiment of the invention, multiple colours of light

can be produced by using a number of light sources with different colours.

In a still further embodiment of the invention the said light sources can be programmable to produce different colour, intensity or patterns.

In a still further embodiment of the invention the said light patterns can also be generated by scanning of optical beams with controlled motion of the one or a number of reflective mirrors.

In a still further embodiment of the invention, the said light sources and/or the said light filter means and/or the said light mask means can be in stationary or can be in motion.

In a still further embodiment of the invention, the said light source can be powered locally at the shower/tap head with batteries or powered remotely and transported to the said light source through electrical leads or optical transmitting means.

In a still further embodiment of the invention, the said optical masks and/or the said optical filters can be fixed or removable or replaceable.

In a still further embodiment of the invention, the said light projected into the water can be switched on/off manually or automatically in accordance with the on/off of the water streams flowing to the exit of the said shower head or water taps, or in accordance to the said water conditions.

In a still further embodiment of the invention the parameters of the said light such as colour or pattern or intensity or brightness can be adjusted manually by the user or adjusted automatically by a control means according to the water conditions to provide means of non-contact indicating the water conditions by the water streams for end use.

In a still further embodiment of the invention, the said control means may include water condition sensing means, light intensity/pattern/colour control means or programmers, optical mask control means, and manual control means.

In a still further embodiment of the invention, the said water condition sensing means may include commercial sensors or detectors or transducers for water temperature, water flowrate/pressure, water pH value, water hardness, cleanness or chemical contents sensing and to generate, say, electrical, or optical or mechanical or magnetic signals for the said light control means or mask/filter control means.

In a still further embodiment of the invention, the said light control means may include variable electric current means, variable electric voltage means, variable electrical resistance means, variable inductance means or variable capacitance means or variable optical polarisation means or variable optical chopping means (blocking the beam periodically) or programmable pulse generator means or mechanical means or digital programmable means with or without a micro-processor or combinations of them to vary the electrical supply to the light sources or vary the said light directly to obtain desired intensity and/or colour and/or patterns

of the said light to be injected into the water or already injected into the water for the sanitary purposes.

In a still further embodiment of the invention, the said optical mask/filter control means may include a motion control means such as an electric motor or a hydraulic motor or solenoids or pneumatic control vales to vary the position of the said optical masks or filters aligned with the said light source, or a programmable liquid crystal device to vary the light transmission through it or polarisation control device to vary polarisation transmission if the light source is polarised.

In a still further embodiment of the invention the said light source can be placed, introduced or embedded in the bath tub for the illuminated effects when the path is filled with water.

In a still further embodiment of the invention the parameters of the said light source can be controlled or varied manually or automatically according to the water conditions in use.

In a still further embodiment of the invention, audible sound or music can be incorporated in the sanitary installations produced with one or a number of sound generating means in accordance with the said water condition or with the said light variations to provide, say audible warning, voice and musics.

In a still further embodiment of the invention the said light source can also include infrared, ultraviolet and other wavelengths, in particular that of sun light (preferably without the ultraviolet components of the sun light for safety reasons) to enable sun bathing and shower to be combined at bathrooms. When an infrared light source is used, medical treatment effect could be generated to the skin or human/animal body.

SPECIFIC DESCRIPTIONS

The invention is now further described by way of examples only, with reference to the accompanying drawings in which:-
Fig.1. is a diagram illustrating a simple version of an illuminated water shower installation with visible light or electromagnetic waves injected into water streams in a shower head or water tap directly.

Fig.2. is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location to the shower head and the light/electromagnetic waves being transmitted to the shower head or water tap in and/or along with the water transportation means with multiple reflecting mirrors and optical waveguide of the section of the water transporting means. A water condition sensing and light control unit is also described.

Fig.3. is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location from the shower head or water tap and the light/electromagnetic waves being transmitted to the shower head or water tap with a multiple mirror based beam guide separated from the water transportation means. A water condition sensing and light control unit is also described.

Fig.4.is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location from the said shower head or water tap and the light/electromagnetic waves being transmitted to the shower head or water tap with an optical fibre means not coaxial to the said water transporting means. A water condition sensing and light control unit is also described.

Fig.5.is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location from the said shower head or water tap and the light being transmitted to the shower head or water tap with an optical fibre means in/along with the water transportation means. A water condition sensing, light control and sound generation unit is also described.

Fig.6. is a diagram illustrating three examples of stationary optical masks/filters.

Fig.7. is a diagram illustrating three examples of mobile optical masks/filters.

Referring now to the drawing in the **Figs.1**. which shows schematically a shower/bath installation with illuminated water streams as one embodiment of the present invention, wherein a light source **1**, which may be enclosed with a water proof box member **20** which may allow the light to transmit through from one or a number of locations, is placed on/at the shower/tap head **4** (the tap is not shown here). An optical mask/filter **2**, which may consist of a plastic or glass sheet with different colours and geometry patterns or symbols, is placed between the light source **1** and an optical transparent window **3**, which may be of plastic or glass material, fitted and sealed at the back face of the shower head **4**. The mask or masks **2** can be removable or changeable by, say, sliding in/out the slot between the light source **1** and the transparent window **3**. Water streams **10** are carried by a water pipe **9** , which may be rigid or flexible, to the shower/tap head **4**. The light rays **5** from the light source **1** totally or partially pass through the light mask **2**. The re-emerged light **6** from the mask **2** will have colours and patterns determined by the mask/filter colours, geometries and patterns. For example a red coloured mask will only allow the red light to pass through. This light **6** is injected into the water **7** in the shower/tap head **4** through the water sealed transparent window **3**, so that the said water **7** will be illuminated by carrying part or whole of the light **6** with it when emerging from the shower/tap head outlet for end use. Thus the emerged shower water streams **8** , will have some light trapped in the water streams due to higher refractive index of the water compared to air. This gives a glowing or illuminated effect of the water streams which can be of different colour or pattern or intensity without using additional chemical/dye deposition in the end use water. The light source **1** can be switched on and off by a switch **26**. The light intensity can be adjusted by a control device **27** which may be of variable resistance, or capacitance, or inductance or a semiconductor nature, or the combination of them. The light can be continuous or pulsed. An optional pulse generator **28** can be used to control the light pulses by user selections or definitions. The colour and/or geometric patterns of the light injected into the shower/tap head **4** can be changed or varied with different masks **2**. The lead member **30** can be an electrical or optical one (such as fibre optics, optical waveguide, or multiple mirrors) depending on whether the actual light generating means

is located at the shower head **4** or placed at a separate location.

The said light source **1** can also be itself coloured. In this case the colour function of the said optical masks may or may not be used. The masks in this case can be used to block part of the light beams from the light sources to select colours or to create patterns. Mechanical shoppers (blocking the beam periodically in a defined pattern), liquid crystal displays or polarising control means can be used in replace of the optical mask/filter in this case for the controlled light transmission.

Fig.2. shows a more complicated version of the sanitary installation wherein the water condition (temperature, flowrate/pressure, chemical composition and quality etc.) can be used to control the parameters of light carried in the shower/tap water streams. In this particular example a multiple reflecting mirror (**14**, **15**) means is used as optical transmission means, which can be placed inside (as shown in the drawing), along with or separated (not shown in the drawing) from the water carrying pipes. The light source **1** is placed remotely from the shower head **4**. Light **5** emitted from the light source **1** is shone on a stationary or a mobile mask means **17** which is placed between the light source **1** and a transparent window **3** leading to the water path. The said mask **17** can have colours and/or patterns. Some examples of the mask **17** is shown in **Fig.7**. The light **6** emerged from the mask **17** will be determined by the colour(s) and pattern(s) of the mask **17**. This light **6** enters the water stream **10** through a transparent and water proof window **3**. Light **6** is then reflected by a reflective mirror **14** to the shower/tap head **4** where another light reflector/mirror **15** is used to direct the light into the water **7** in the shower/tap head **4**. A number of reflecting mirrors can be placed between members **14** and **15** depending on the number of elbows of the pipe **9** has. The mirror means can be a metal piece with polished or coated surface, or a glass piece with reflective coatings or a optical prism. The water streams **8** exited from the shower/tap head will then carry the light with them. One or a number of water parameter sensing means **29** is(are) inserted into or placed near the water stream lines **10**. These sensors can be one or a number of a water temperature sensor such as a thermocouple, a thermal resister (This sensor does not need to be inserted into the water; it can be placed on the wall of thermally conductive water pipe line **9**), a water flowrate/pressure sensor or a water quality (chemical composition, pH value, turbidity, purity, hardness etc.) sensors. The detector signals on the water condition are sent to a controller **11** subject to selection by a menu/auto switch **22**. If the selection is "auto", then the detected water parameter singles are used to drive the control output(s) **24**. Otherwise the controller **11** is controlled by a user adjustment device **23** such as a switch, rotating knobs or sliding devices of, say, variable resistance nature. The function of the controller **11** is to produce electrical and/or mechanical and/or chemical and/or magnetic and/or optical outputs **24** to vary the pattern and/or colour and/or intensity and or pulse of the light **6** emerging from the mask **17** to the water stream. One of the ways to do so is to rotate the patterned mask disk **17** with an electric motor **12** or a spring loaded mechanical device **12**. The light intensity is varied by controlling the electrical input voltage or current or pulse parameters of the light source **1** using the controller **11**. The pulsing of the light can also be realised by chopping the light by a patterned mechanical choppers. Therefore the water steams **8** exited from the shower/tap head

to the end users will carry lights that are indicative of water conditions with varying colours, patterns or intensity. This feature is not only useful for domestic and commercial sanitary use for the increased convenience and safety but also useful for environmental and industrial water pollution monitoring. The water pipe lines **9** can be connected to the water monitoring and light control box **16** through connecting members **18**. The section of the water pipelines between mirrors **15** and **14** can be coated with optical reflective materials to reduce the optical energy losses. This section of pipelines can then be used as an optical waveguide.

Fig3. shows a similar design as illustrated in **Fig.2** apart from that the optical tranmission means (**13,14,15**) using multiple mirrors are placed seperated from the water pipe lines **9**. The tranmission line **13** can be a hollow tube with multible elbows (each with a reflective mirror) allowing several degrees of freedom in motion. The multiple elbows are not shown in the figure. Other parts of the figure are identical to **Fig.2**.

Fig.4. shows a water parameter controlled illuminated water sanitary (shower) system with fibre optic light delivery **19** outside the water transportation means **9**. Light emerging from the optical mask **17** can be fed into a single or a bundle of optical fibres **19**. A light collecting components such as a lens **31** between the mask or light source and the end of optical fibres **19** may or may not be used to guide the light into the fibres **19**. The optical fibre **19** can be placed outside/along the water pipe line **9** which can be rigid or flexible. At the shower/bath head **4** the light emerging from the optic fibres can be fed into shower head water **7** through a light transparent window **3**. An optical component or components such as a lens **21** placed between the fibre optics **19** and the transparent window **3** may or may not be used to guide the light emerging from the fibre optics through the transparent, sealed (water proof) window **3** into the shower head **4**. The optics **21** can be placed in a water proof box **20**. The rest of the illustrations in this figure are identical to those in **Fig.2**. In some cases, lenses may not be used for optical fibres and each fibre in the bundles of fibres can be placed at a given pattern or set loose.

Fig.5. shows a water parameter controlled light carrying sanitary (shower/bath) system with fibre optic light delivery inside the water streams and also an included sound generating member **25**. In this approach the optical fibre(s) **19** transmitting the light from the light source **1** to the shower/tap head **4** is(are) placed inside the water transporting pipe **9**. In addition, a sound generating device **25**, such as a loud speaker, or a semiconductor buzz or a voice synchroniser or a tape/disk player is used to produce certain sound or music according to the controller **11** outputs which can be related to the water conditions. Other parts of the drawings are identical to those in **Figs.2** and **4**.

Fig.6.shows three examples of the optical masks mentioned in **Fig.1**.as member **2**, where **2.A** illustrates a single coloured mask, **2.B** illustrate a multiple coloured mask and **3.C** illustrates a patterned mask with artistic designs/symbols. The masks can be in other geometric shapes not illustrated.

Fig.7. shows three examples of optical masks used in **Figs.2,3, 4** and **5**

as number **17**, wherein **17.A** illustrates a mask with mixed colours or patterns and can be rotatable. **17.B** illustrates a mask with continuous varying colours and the mask can be in motion. **17.C** illustration an optical mask with different signs or patterns. The mask can be in motion so that the part aligned with the light source can be varied accordingly.

It should be noted that part or combinations of the above features described in **Figs.1** to **7** can be utilized for a sanitary installation.

CLAIMS

1. A method of increasing the convenience, safety and pleasure of water sanitary by introducing electromagnetic waves, especially, visible lights into the water streams in the sanitary installations such as shower, bath, or hand/face wash installations so that the said lights are carried, and guided by the said water (illuminated) exiting the said shower head or water taps for sanitary purposes.

2. Apparatus of producing illuminated water in the sanitary installations by introducing electromagnetic waves, especially, visible lights into the water streams in the sanitary installations such as shower, bath, or hand wash installations before or just after the said water streams exit from the shower head or water taps so that the said lights are carried, and guided by the said water (illuminated) exiting the said shower head or water taps for sanitary purposes. The said apparatus may include some or all of the following components:

A water sanitary means such as a shower unit or a water mixer, a water heater or water taps producing water(s) with a temperature and flowrate or pressure and forms known or not known.

One or a number of light or electromagnetic wave generating means

One or a number of optical or electromagnetic wave transmission means

One or a number of optical masking or filtering, polarisation, and pattern generation means

One or a number of water condition sensing means

One or a number of water proofing, and/or optical/electrical components protecting means

One or a number of optical light, electromagnetic wave control means

One or a number of optical mask/filter control means

One or a number of sound generating means

One or a number of sensor signal coordinated control means.

One or a number of means of connecting the water sensing, light/electromagnetic waves control means, and light or electromagnetic waves to the sanitary installation or water streams.

3. A method of visually indicating the water conditions such as temperature, flowrate/pressure, and quality (cleanness, excessive chemicals, pH values, hardness etc.) of water by the light carried in the flowing water streams exiting from a shower head or a water tap for end use.

4. Apparatus of visually indicating the water conditions such as temperature, flowrate/pressure, and quality (cleanness, excessive chemicals, pH values, hardness etc.) of water by the light carried in the flowing water streams exiting from a shower head or a water tap for end use. The said apparatus may include some or all of the following components:

A water generating means producing water(s) with a temperature and flowrate or pressure and chemical contents and forms known or not known.

A water transporting means such as a metal or nylon or a rubber or a plastic pipe line

A water exit control means such as a shower head, a water mixture, a water heater or a water tap

One or a number of light generating means
One or a number of optical transmission means
One or a number of optical masking or filtering, polarisation, and pattern generation means
One or a number of water condition sensing means
One or a number of water proofing, and/or optical/electrical components protecting means
One or a number of optical light control means
One or a number of optical mask/filter control means
One or a number of sound generating means
One or a number of sensor signal coordinated control means
One or a number of means of connecting the water sensing, light control means, and light beams to the said water streams and water unit.

5. Methods and apparatus as claimed in claims 1,2,3 and 4, wherein the said light/electromagnetic waves injected into the said water streams can be colourless, single coloured, multiple coloured, or mixed coloured, infrared, visible, or ultraviolet or a combination of some or all of them.

6. Methods and apparatus as in claimed claims 1, 2, 3 and 4, wherein the said light/electromagnetic waves injected into the said water stream can be patterned, constant intensity, or varying intensity including pulsed mode or polarised.

7. Methods and apparatus as in claimed claims 1, 2, 3 and 4, wherein the colour or wavelengths or spectrums of the said light to be or already injected into the water can be varied manually or automatically according to water conditions such as temperature, pressure/flowrate or the quality of the water.

8. Methods and apparatus as claimed in claims 1, 2, 3 and 4, wherein the pattern, intensity, state of polarisation and intensity distribution of the said light to be or already injected into the said water can be varied manually or automatically according to the water conditions such as temperature, pressure/flowrate or the quality of the water.

9. A method and apparatus as claimed in claims 1,2,3 and 4, wherein the on/off of the said light can be controlled by a manual switch means or by the pressure/flowrate of the said water in the pipe line or by the water tap position to synchronise with the on/off of the water.

10. Methods and apparatus as claimed in claims 1, 2, 3 and 4, wherein the said light/electromagnetic wave generating means may be one or a number of light bulbs, one or a number of light emitting diodes (which may or may not be programmable) or one or a number of lasers, or one or a number of infrared wave generating means such as a thermal/electric resistor or a semiconductor means or an infrared light bulb, or an arc lamp or other types of electromagnetic waves generator.

11. A method and apparatus as claimed in claim 9, wherein the said light source can be powered locally at the shower/tap head with batteries or powered remotely and transported to the said light source through electrical leads or optical transmitting means.

12. A method and apparatus as claimed in claims 1, 2, 3 and 4, wherein

the location of the said light source can be in close proximity, or on, or in, or along or around but attached to, or at a distance to, the said shower head or water taps.

13. Methods and apparatus as claimed in claims 1,2,3 and 4, wherein the said optical transmitting means is used to guide or transmit the said light/electromagnetic waves from the said light/electromagnetic source to the said light/electromagnetic wave entering point to the water stream.

14. Methods and apparatus as claimed in claims 2 and 4, wherein the said optical transmitting means may include one or a number of the following: a). optical fibre means which may or may not require focusing lenses for the collection and re-distribution of optical energies; b). optical waveguide means (a tube that transmitting the optical energy from one end to the other by multiple reflections through the inner walls of the tube.) which can be a separate device or a section of the water transporting unit such as water pipes used in the sanitary installations. Preferably the inner walls of the waveguide is optically reflective, which can be realised by cladding or coating of reflective materials or polishing if a metal tubing is used; c). multiple reflecting mirrors located at two ends and elbows of a rigid tube to reflect the light or electromagnetic waves from one end to the other. The said rigid tube for multiple reflecting mirrors may not be needed in some cases. The said reflective mirrors can be made of metal optics such as aluminium or copper or alloying materials, or optical prisms such as glass or plastics coated with reflective coatings.

15. A method and apparatus as claimed in claim 14, wherein the optical transmitting means may be placed inside, along with, on, at or separated from the said water installations or water transporting means and said water exiting control means.

16. A method and apparatus as claimed in claims 1,2,3 and 4, wherein one or a number of optical masking/filtering means can be placed between the said light source and the water stream to produce coloured or patterned or varying lights from the said light source which may be at stationary and produce broad spectrum light.

17. A method and apparatus as claimed in claim 16, wherein the said optical masking, filtering means can be stationary or in motion, fixed or removable (changeable).

18. A method and apparatus as claimed in claim 17, wherein the said optical masking/filtering means can be one or a number of a plastic or a glass sheet in various geometry and with various colours and/or patterns or a liquid crystal display device controlling the light transmissions through it or a polarisation device controlling the direction/angle of polarisation transmission for a polarised light or a motion controllable scanning mirror producing patterned lights.

19. A method and apparatus as claimed in claims 1, 2, 3 and 4, wherein one or a number of transparent windows (water proof) can be placed between the said light source or masking/filtering means and the said water streams.

20. An apparatus as claimed in claim 19, wherein the said transparent

window should be able to stand the temperature and chemical or pressure attacks of the water and the window can be sealed to the water installations to prevent water leak.

21. A method and apparatus a claimed in claims 1,2,3 and 4, wherein the optical control means is used to vary the said light source conditions such as intensity, on/off, colour, polarisation or operating modes (such as intensity distribution, pulse shape, frequency, continuous or pulsed, manual or automatic etc.) etc.

22. An apparatus as claimed in claim 21, wherein the said light control means may include one or a number of the following: a pulse generator to vary or control directly or indirectly the electric supply to the said light source, a variable resistance means to vary or control directly or indirectly the electric supply to the said light source, a variable capacitance or inductance means to vary or control directly or indirectly the electric supply to the said light source, a semiconductor means to control directly or indirectly the electric power supply, a manual or automatic switching means to control directly or indirectly the electric supply to the said light source, a light polarisation means to polarise the said light source, a electro/mechanical chopping means to chop (block periodically in a pre-designed pattern) the said light source, a liquid crystal display (LCD) device to control the transmission of the said light source.

23. Methods and apparatus as claimed in claims 1,2,3 and 4, wherein the said water condition sensor means is used to detect the said water condition and to produce electrical, optical, magnetic or mechanical signals for the said sensor signal coordinated control means to vary the said light parameters and masking/filter conditions accordingly.

24. An apparatus as claimed in claim 23, wherein the said water condition sensor means may include one or a number of the following: a water temperature sensor (such as a thermocouple, a thermopile, a thermal resistor or thermal expansion sensitive materials), a water pressure/flowrate sensor, a pH sensor, a water hardness sensor, a water chemical content (fluorine etc.) sensor or a water turbidity sensor.

25. An apparatus as claimed in claim 24, wherein water condition sensor means can be placed in or at certain distances to the said shower head or water taps.

26. Methods and apparatus as claimed in claims 1, 2, 3 and 4, wherein the said optical mask/filter control means is used to vary the conditions of the said optical mask/filter means so that various colours, patterns and intensities of of light can be generated dynamically from a stationary, polarised or broad spectrum light source.

27. An apparatus as claimed in claim 26, wherein the said optical mask/filter control means can be an electric motor or a mechanical spring loaded device connected to the said optical mask/filter means.

28. An apparatus as claimed in claim 27, wherein the said optical mask/filter control means can be controlled by a manual variation device or by the said water condition sensing signal coordinated control means.

29. Methods and apparatus as claimed in claims 1, 2, 3 and 4, wherein the said water condition sensing signal coordinated control means is to used to control the action and modes and behaviour of the said light control means and masking/filtering control means according the signals produced by the said water condition sensors or manual control demands.

30. Methods and apparatus as claimed in claim 29, wherein the said water condition sensing signal coordinated control means can be an electronic device, an electrical device, an optical device, a chemical device or a mechanical device with or without a microprocessor.

31. A method and apparatus as claimed in claims 1, 2, 3 and 4, wherein a sound generating means can be used to produce sound or music with the the variation of the said lights and/or water conditions.

32. A method and apparatus as claimed in claim 31, wherein the sound generating means may be one of a number of a loud speaker, a electronic buss, a bell, a tape player, a disk (say ,CD) player, a voice synchroniser, a semiconductor device not included in the above mentioned items.

33. A method and apparatus as claimed in claim 32, wherein the said sound or music can be varied or triggered to start according to the water conditions.

34. A method and apparatus as claimed in claims 1, 2,3 and 4 wherein the inner walls of the section of the water installations such as the water pipe lines, between the said light entering point and the exit points of the water from the shower head or water tap, can be coated with light reflective materials.

35. An method and apparatus as claimed in claims 1, 2,3 and 4, wherein the sanitary water installations can be connected to the light control box through one or a number of connectors, which links the sanitary water pipe lines in and out of the light control box.

36. A method and apparatus as claimed in claims 1,2,3 and 4, wherein a number of optical lens means and mirror means can be used to collect the light from the said light from the optical transmitting means and to deliver the light to the said water stream.

37. A method and apparatus as claimed in claims 1,2,3 and 4, wherein the said light source can be placed, or introduced or embedded in the bath tub so that the water used for bath can be illuminated when filled the bath tub.

38. A method and apparatus as claimed in claim 37, wherein the parameters of the said light can be controlled manually or automatically according to the said water conditions.

39. A method and apparatus as claimed in claims 1,2 and 37 wherein the said sanitary installations with illuminated (especially colour light illuminated) water can be used to provide additional pleasure for water sanitary such shower, bath or hand/face washing.

40. A method and apparatus as claimed in claims 1, 2,3,4 and 38 wherein

the said sanitary installations with illuminated (especially colour light illuminated) water can be used to provide additional convenience and safety for water sanitary such shower, bath or hand/face washing when the said light parameters such as colour or intensity is variable with the water conditions such temperature.

41. A method and apparatus as claimed in claims 1, 2 and 37 wherein the said illuminated water sanitary installations can be used for the combined sun bathing and water showering/washing.

42. A method and apparatus as claimed in claims 1,2 and 37 wherein the said sanitary installations with electromagnetic wave carrying water streams can be used for medical treatment of human and animal body if an infrared light beam is used as the said light source.

43. A method and apparatus a claimed in claims 3, 4 and 38, wherein the said, non-contact, visual means of indicating water condition flowing out of the water taps for end use can be used for both domestic, commercial, environmental and industrial use for water condition monitoring.

44.Water sanitary installations or components substantially as described herein with reference to **Figures 1-7** of the accompanying drawings.

17

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Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASE: WPI

Documents considered relevant following a search in respect of Claims :-
1-44

Categories of documents

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Category	Identity of document and relevant passages	Relevant to claim(s)
X	FR 2562637 A (DANDREL)	1 AND 2 AT LEAST

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